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**Mahesh P Ningegowda**  
Department of Fruit Science,  
College of Horticulture,  
Bagalkot, Karnataka, India

**Kulapati Hipparagi**  
Department of Fruit Science,  
College of Horticulture,  
Bagalkot, Karnataka, India

**Lokesha R**  
Department of Fruit Science,  
College of Horticulture,  
Bagalkot, Karnataka, India

**Srinivas**  
Department of Fruit Science,  
College of Horticulture, Bidar,  
Karnataka, India

**Mallikarjun Awati**  
Department of Crop Physiology,  
University of Horticultural  
Sciences, Bagalkot, Karnataka,  
India

**Sarvamangala Cholin**  
Department of Biotechnology  
and Crop Improvement, College  
of Horticulture, University of  
Horticultural Sciences, Bagalkot,  
Karnataka, India

**Corresponding Author:**  
**Mahesh P Ningegowda**  
Department of Fruit Science,  
College of Horticulture,  
Bagalkot, Karnataka, India

## Identification of elite seedling progenies of mango for the yield and morphological traits of the fruit under north eastern transitional zone of Karnataka

**Mahesh P Ningegowda, Kulapati Hipparagi, Lokesha R, Srinivas, Mallikarjun Awati and Sarvamangala Cholin**

### Abstract

The investigation was carried out to identify the morphological parameters of the superior seedling progenies of mango in major mango growing parts of Bidar district, Karnataka. Among the 61 seedling selections selected for the investigation, the fruit yield was highest in 'CMS-67' (238 kg/tree) and 'GMS-02' in new and old plant category respectively. The maximum fruit weight (862.00 g), fruit width (117.62 mm), fruit volume (880.00 g/cc), pulp weight (647.72 g) and peel weight (127.30 g) was found in 'CMS-05'. The maximum fruit width was recorded in 'CMS-60'. The highest specific gravity (1.02 g/cc) of fruit was noticed in 'CMS-47'. The highest pulp percentage (81.77%) with the lowest peel percentage (7.51%) was recorded 'GMS-04'. The lowest peel content (11.31g) was observed in 'CMS-46'. The lowest stone weight (15.45 g) was noticed in 'GMS-01', the lowest stone percentage and the maximum pulp to stone ratio (17.24) was recorded in 'CMS-45'. The minimum non-edible part (27.40 g) was recorded in 'CMS-46'. The lowest non-edible percentage (18.23%), lowest fruit to pulp ratio (1.22), highest pulp to peel ratio (10.89) and edible to non-edible ratio (4.49) were noticed in 'GMS-04'. The thicker peel (2.98 mm) was noticed in 'CMS-15' and 'CMS-05'.

**Keywords:** CMS, GMS, fruit yield, fruit weight, pulp percentage, pulp to stone ratio and specific gravity

### Introduction

Mango (*Mangifera indica* L.) is an important member of the family Anacardiaceae, belongs to the order Sapindales and is the most important fruit crop in India having a great cultural, socio-economic and religious significance since ancient times. It is said to be originated in the Indo-Burma (Myanmar) region (De-Candolle, 1904, Vavilov, 1926 and Popenoe, 1920) [5, 15, 13]. Based on geographical distribution, polygenic trend, pollen morphology, chromosome number and breeding behavior indicated the highest concentration of species of *Mangifera* were found in Malayan peninsula followed by Sudan Islands and the Eastern peninsula comprising Burma, Thailand and Indo- China. Its long period of domestication in India is well evidenced from its mention in the ancient scripture.

Enormous genetic diversity of mango exists in India, which is the primary center of domestication. There are more than 2000 monoembryonic and polyembryonic mango cultivars in India. Considerable genetic diversity of this fruit exists in Karnataka with several named local cultivars and unnamed local land races. This genetic variability of mango can be exploited in breeding programs to produce high quality mangoes suitable for a variety of purposes.

Identification of superior elite clones is an important activity in the management of genetic resources in mango in the context of the present scenario of rapid extinction of such useful material. Still there is an immense potential of locating superior seedlings for collection, evaluation, conservation and utilization for the future crop improvement works. Keeping these in view, the present study was aimed to identify the superior seedling progenies of mango by the evaluation of their fruit morphology and quality traits.

### Material and Methods

An investigation on "Studies on variability in seedling progenies of mango under north-eastern transitional zone of Karnataka" was carried out at farmers field in Bidar district, Karnataka. The fruits were brought to the Department of Fruit Science, College of Horticulture, Bidar and were used for analysing the physicochemical characters during 2017-18.

Ten fruits were collected from each of the selected elite trees from the farmer's field in villages of Bidar. Forty eight trees from Chitta, six trees from Gonahalli, three trees from Mudbi and five trees from Yadlapur were selected. The fruits were labeled after they were plucked from the tree and yield per tree recorded by using digital weighing balance and expressed

in kilogram. The weight of the fruit, pulp, peel and stone was recorded using electronic balance and expressed in gram. The length and width of fruit, thickness of peel was measured using digital vernier calipers and it was expressed in millimeter. The fruit volume was measured by the water displacement method and was expressed in milliliter.

**Table 1:** Tree details of young mango seedling selections

Sl. No.	Tree	Place	Farmer's name	Age of a tree (years)
1	CMS - 01	Chitta	Mohammed Jaffer	10
2	CMS - 05	Chitta	Mohammed Jaffer	10
3	CMS - 06	Chitta	Mohammed Jaffer	10
4	CMS - 09	Chitta	Mohammed Jaffer	10
5	CMS - 14	Chitta	Mohammed Jaffer	10
6	CMS - 15	Chitta	Mohammed Jaffer	10
7	CMS - 16	Chitta	Mohammed Jaffer	10
8	CMS - 17	Chitta	Mohammed Jaffer	10
9	CMS - 18	Chitta	Mohammed Jaffer	10
10	CMS - 19	Chitta	Mohammed Jaffer	10
11	CMS - 23	Chitta	Mohammed Jaffer	10
12	CMS - 24	Chitta	Mohammed Jaffer	10
13	CMS - 25	Chitta	Mohammed Jaffer	10
14	CMS - 26	Chitta	Mohammed Jaffer	10
15	CMS - 27	Chitta	Mohammed Jaffer	10
16	CMS - 29	Chitta	Mohammed Jaffer	10
17	CMS - 30	Chitta	Mohammed Jaffer	10
18	CMS - 31	Chitta	Mohammed Jaffer	10
19	CMS - 32	Chitta	Mohammed Jaffer	10
20	CMS - 33	Chitta	Mohammed Jaffer	10
21	CMS - 34	Chitta	Mohammed Jaffer	10
22	CMS - 35	Chitta	Mohammed Jaffer	10
23	CMS - 37	Chitta	Mohammed Jaffer	10
24	CMS - 40	Chitta	Mohammed Jaffer	10
25	CMS - 41	Chitta	Mohammed Jaffer	10
26	CMS - 42	Chitta	Mohammed Jaffer	10
27	CMS - 43	Chitta	Mohammed Jaffer	10
28	CMS - 44	Chitta	Mohammed Jaffer	10
29	CMS - 45	Chitta	Mohammed Jaffer	10
30	CMS - 46	Chitta	Mohammed Jaffer	10
31	CMS - 47	Chitta	Mohammed Jaffer	10
32	CMS - 49	Chitta	Mohammed Jaffer	10
33	CMS - 51	Chitta	Mohammed Jaffer	10
34	CMS - 52	Chitta	Mohammed Jaffer	10
35	CMS - 53	Chitta	Mohammed Jaffer	10
36	CMS - 54	Chitta	Mohammed Jaffer	10
37	CMS - 55	Chitta	Mohammed Jaffer	10
38	CMS - 56	Chitta	Mohammed Jaffer	10
39	CMS - 57	Chitta	Mohammed Jaffer	10
40	CMS - 58	Chitta	Mohammed Jaffer	10
41	CMS - 59	Chitta	Mohammed Jaffer	10
42	CMS - 60	Chitta	Mohammed Jaffer	10
43	CMS - 61	Chitta	Mohammed Jaffer	10
44	CMS - 62	Chitta	Mohammed Jaffer	10
45	CMS - 63	Chitta	Mohammed Jaffer	10
46	CMS-67	Chitta	Mohammed Jaffer	10
47	GMS - 06	Gonahalli	Gundappa	9
48	YMS - 01	Yadlapur	Shivakumara Swamy	16
49	YMS - 04	Yadlapur	Shivakumara Swamy	16
50	YMS -05	Yadlapur	Shivakumara Swamy	16
51	YMS - 06	Yadlapur	Shivakumara Swamy	16
52	YMS - 07	Yadlapur	Shivakumara Swamy	16

**Table 2:** Tree details of old mango seedling selections

Sl. No.	Tree	Place	Farmer's name	Age of a tree
1	CMS - 68	Chitta	Mohammed Jaffer	55
2	GMS - 01	Gonahalli	Gundappa	60
3	GMS - 02	Gonahalli	Gundappa	60
4	GMS - 03	Gonahalli	Gundappa	60
5	GMS - 04	Gonahalli	Gundappa	60
6	GMS - 05	Gonahalli	Gundappa	60
7	MMS - 01	Mudbe	Sathish Patil	75
8	MMS - 02	Mudbe	Sathish Patil	75
9	MMS - 03	Mudbe	Sathish Patil	75

Fruit specific gravity (g/ cm<sup>3</sup>), Pulp percentage (%), Peel percentage (%), Stone percentage (%), Non edible fruit part weight (g), Non edible fruit part percentage (%), Fruit to pulp ratio, Pulp to peel ratio, Pulp to stone ratio and Edible to non-edible ratio were calculated by using following formulas.

#### Fruit specific gravity (g/ cm<sup>3</sup>)

The specific gravity was calculated as per the formula is given below

$$\text{Specific gravity} = \frac{\text{Total weight of five fruits}}{\text{Total vol. of replaced water by five fruits}} \times 100$$

#### Pulp percentage (%)

Pulp percent was calculated by using the following formula and expressed in percentage.

$$\text{Pulp percent} = \frac{\text{Pulp weight}}{\text{Fruit weight}} \times 100$$

#### Peel percentage (%)

The peel percentage per fruit was calculated by following formula and expressed in percentage.

$$\text{Pulp percent} = \frac{\text{Peel weight}}{\text{Fruit weight}} \times 100$$

#### Stone percentage (%)

Stone percent was calculated by using the following formula and expressed in percentage.

$$\text{Stone percent} = \frac{\text{Stone weight}}{\text{Fruit weight}} \times 100$$

#### Non edible fruit part weight (g)

The peel and stone of five fruits was taken and weighed with the help of electronic balance separately and the sum was averaged for computing average peel and stone weight and expressed in gram.

#### Non edible fruit part percentage (%)

The non-edible fruit part percentage per fruit was calculated by following formula and expressed in percentage.

$$\text{Pulp percent} = \frac{\text{Peel weight} + \text{Stone weight}}{\text{Fruit weight}} \times 100$$

#### Fruit to pulp ratio

The fruit/pulp ratio was calculated using the following formula:

$$\text{Fruit to pulp ratio} = \frac{\text{Total weight of the fruit}}{\text{Weight of the pulp}}$$

#### Pulp to peel ratio

The pulp/peel ratio was calculated using the following formula:

$$\text{Pulp to peel ratio} = \frac{\text{Total weight of the pulp}}{\text{Weight of the peel}}$$

#### Pulp to stone ratio

The pulp to stone ratio was calculated using the following formula:

$$\text{Pulp: stone ratio} = \frac{\text{Total weight of the pulp}}{\text{The weight of the stone}}$$

#### Edible to non-edible ratio

The edible to non-edible ratio was calculated using the following formula:

$$\text{Edible to non - edible ratio} = \frac{\text{Pulp weight}}{\text{Peel weight} + \text{stone Weight}}$$

#### Statistical analysis

The statistical mean was calculated using the method suggested by Goulden (1952) [8]. Range was calculated based on the difference between the lowest and the highest values recorded. The coefficient of variation was computed according to Burton and Devane (1953) [4].

#### Results and Discussions

##### Fruit Morphological Characters

The weight of fruit will have direct impact on the yield and productivity of the selection. Among the seedling selections, the fruit weight ranged from 87.17 g in 'CMS-46' to 862.00 g in 'CMS-60' (Table 1). This variation in fruit weight indicated the better option for selection of this character. Similar results in fruit weight ranged from 178.00 g in 'BN Acc-8' to 474.00 g in 'BN Acc-25' (Begum *et al.*, 2013) [3]; 130.00 g in 'CKR Acc-19' to 380.00 g in 'CKR Acc-29' (Begum *et al.*, 2014) [16] and 120.00 g in 'Pusa Mango-7' to 510.00 g 'Pusa Mango-2' (Singh *et al.*, 2015) [14].

The fruit length showed variation among the selections which ranged from 52.32 mm in 'MMS-03' to 149.12 mm in 'CMS-60'. The fruit width varied from 51.39 mm in 'CMS-30' to 117.62 mm in 'CMS-05' (Table-03). The variation among the accessions of 'Baneshan' ranged between 8.00 cm in 'BN Acc-5' and 13.00 cm in 'BN Acc-25' for fruit length, 6.00 cm in 'BN Acc-14' to 9.10 cm in 'BN Acc-4' for fruit width and 5.00 cm in 'BN Acc-6' to 7.90 cm in 'BN Acc-16' for thickness (Begum *et al.*, 2013) [3] which is in confirmity with the present study. Mukunda (2004) [10]; Begum *et al.* (2014) [16]; Singh *et al.* (2015) [14] and Dinesh *et al.* (2015) [7] also reported similar results. The variation in fruit length and fruit width could not only be due to the genetic makeup of the

clones but also due to the differential crop load and management of the trees under the study.

The fruit volume of seedling selections varied from 88.00 ml in 'CMS-46' to 880.00 ml in 'CMS-05' (Table - 1). The clones of Alphonso also had the similar fruit volume of 227.34 ml in 'AA-5' (Mukunda, 2004) <sup>[10]</sup>. The volume of fruits was found to be lower than the fruit weight, which resulted in the value of specific gravity to be more than 1 in these selections (Table-03).

There was no high difference among the seedling selections for specific gravity. However, the specific gravity ranged from 0.96 g per cc in 'CMS-32' to 1.02 g per cc in 'CMS-47' (Table -03). Similarly, specific gravity of the mango varieties in Kerala varied from 1.00 g per cc in 'H-151' to 1.02 g per cc in 'Alphonso' (Anila and Radha, 2003) <sup>[2]</sup>.

High pulp weight is an important character, which is essential for selection of the better selections in mango. The pulp weight among the seedling selections was found to be varied from 53.56 g in 'CMS-43' to 647.72 g in 'CMS-05' (Table-04). Similarly, the pulp weight ranged from 76.05 g in 'CKR Acc-19' to 254.22 g in 'CKR Acc-29' (Begum *et al.*, 2014) <sup>[16]</sup> and 50.40 g in 'Pusa Mango-7' to 392.70 g in 'Pusa Mango-2' (Singh *et al.*, 2015) <sup>[14]</sup>.

Peel of the mango fruit accounts to non-edible portion of the fruit. Hence, less peel weight is a desirable character in mango. The peel weight in the present study varied from 11.31 g in 'CMS-46' to 127.30 g in 'CMS-05' (Table-04). Likewise, the peel weight ranged from 29.90 g in 'CKR Acc-19' to 74.10 g in 'CKR Acc-29' (Begum *et al.*, 2014) <sup>[16]</sup> and 30.00 g in 'Pusa Mango-1' to 80.00 g in 'Pusa Mango-18' (Singh *et al.*, 2015) <sup>[14]</sup>.

More pulp weight may not give the exact idea of edible portion present in the fruit. However, relative amount of the pulp gives better idea about the edible portion of fruit. The high pulp percentage, low peel percentage, low stone percentage and high pulp to stone ratio are the desirable characters in mango. Kaur *et al.*, (2014) <sup>[9]</sup> reported the variation in pulp/stone ratio in mango from 1.80 in 'Local selection-1' to 7.29 in 'Langra Banarasi'. In the present study, pulp to stone ratio ranged from 1.67 in 'CMS-43' to 17.24 in

'CMS-45' (Table-04).

Pulp percentage varied between 53.65 percent in 'CMS-43' and 81.77 percent in 'GMS-04' (Table-04). This result is confirmed with the range of pulp contents of mango from 67.56 percent in 'Bemcorado' to 83.21 percent in 'RC-MS-1' (Desai and Dhandar, 2000); 53.80 percent in 'BN Acc-8' to 78.10 percent in 'BN Acc-21' (Begum *et al.*, 2013) <sup>[3]</sup>; 54.30 percent in 'CKR Acc-6' to 67.40 percent in 'CKR Acc-29' (Begum *et al.*, 2014) <sup>[16]</sup> and 43.00 percent in 'PusaMango-7' to 77.00 percent in 'Pusa Mango-2' among the superior clones of mango (Singh *et al.*, 2015) <sup>[14]</sup>.

Fruit skin thickness was ranged from 0.64 mm in GMS-64 to 2.05 mm in CMS-15. The present findings are in agreement with Simi (2006) who reported similar range of fruit skin thickness (0.60 mm to 2.00 mm) in mango. The data pertaining to fruit to pulp ratio revealed wide differences among the cultivars. Lower the fruit to pulp ratio means higher the edible part. Fruit to pulp ratio ranged from 1.22 in GMS-05 to 1.86 in CMS-43 (Table-04). The results are in agreement with Aatla (2015) <sup>[1]</sup> who reported similar range of fruit to pulp ratio (1.18 to 1.48) in mango.

The pulp to peel ratio revealed wide difference among the cultivars (Table-04). The pulp to peel ratio of mango cultivars studied in the present investigation ranged from 2.21 to 10.89. The results are in agreement with Aatla (2015) <sup>[1]</sup> who reported similar range of pulp to peel ratio (4.37 to 9.92) in mango.

The results presented in Table 04 revealed that the mean edible to non-edible ratio was 2.35, while it ranged from 1.16 in CMS-43 to 4.49 in GMS-04. The results are in agreement with Aatla (2015) <sup>[1]</sup>. The worker reported similar range of edible to non-edible ratio (5.59 to 2.00) in mango.

Among the sixty-one selections, the fibre content was low in 42.62 percent selections, 29.51 percent selections had high fibre and 27.87 percent selections had intermediate fibre (Table-04). Similar result was reported by Aatla (2015) <sup>[1]</sup> in mango. It was observed that the fibre content on stone was low in fifteen mango cultivars (44.11%), intermediate in thirteen mango cultivars (38.23%) and high quantity of fibre was observed in six mango cultivars (17.64%).

**Table 3:** Fruit physical parameters of mango seedling selections at villages of Bidar district

Selections	Yield (kg/tree)	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Fruit volume (ml)	Specific gravity (g/cc)
CMS - 01	77.00	227.80	77.52	73.84	226.00	1.01
CMS - 05	44.00	862.00	139.40	117.62	880.00	0.98
CMS - 06	56.00	155.87	82.16	63.86	157.00	0.99
CMS - 09	53.00	260.40	94.80	76.13	258.00	1.01
CMS - 14	12.00	221.20	114.40	68.36	228.00	0.97
CMS - 15	47.00	393.33	118.34	81.25	393.00	1.00
CMS - 16	104.00	470.40	126.33	92.20	475.00	0.99
CMS - 17	14.00	171.20	78.05	72.91	173.00	0.99
CMS - 18	41.00	211.70	106.63	74.94	214.00	0.99
CMS - 19	32.00	194.60	99.48	83.29	201.00	0.97
CMS - 23	19.00	267.89	120.54	94.78	271.00	0.99
CMS - 24	46.00	194.50	90.81	72.23	196.00	0.99
CMS - 25	28.00	229.20	107.58	67.03	227.00	1.01
CMS - 26	41.00	283.20	97.27	92.51	280.00	1.01
CMS - 27	74.00	261.60	99.00	78.46	262.00	1.00
CMS - 29	26.00	170.40	84.00	73.64	176.00	0.97
CMS - 30	84.00	100.50	68.29	51.39	103.00	0.98
CMS - 31	33.00	368.40	95.61	92.93	368.00	1.00
CMS - 32	67.00	238.80	82.19	70.51	249.00	0.96
CMS - 33	162.00	293.00	108.79	80.77	290.00	1.01
CMS - 34	69.00	185.50	92.29	68.07	186.00	1.00
CMS - 35	52.00	204.17	93.28	64.08	206.00	0.99

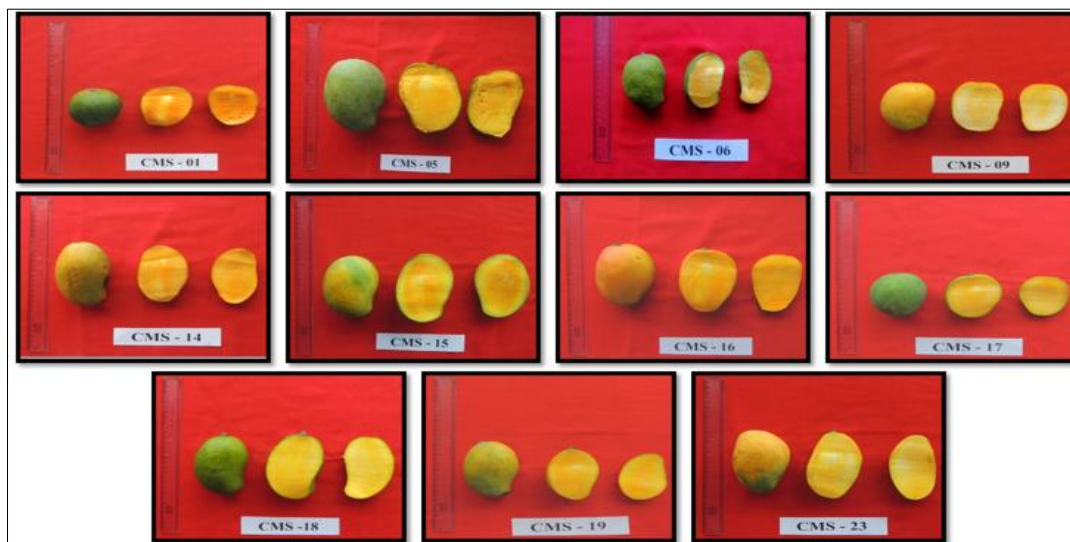


CMS - 37	33.00	150.00	82.44	58.53	152.00	0.99
CMS - 40	77.00	168.40	93.03	66.70	168.00	1.00
CMS - 41	118.00	156.20	91.36	63.13	155.00	1.01
CMS - 42	53.00	500.00	122.23	102.20	510.00	0.98
CMS - 43	213.00	99.83	71.18	59.22	101.00	0.99
CMS - 44	57.00	148.00	74.76	68.47	148.00	1.00
CMS - 45	20.00	426.00	130.40	87.16	422.00	1.01
CMS - 46	104.00	87.17	70.27	57.59	88.00	0.99
CMS - 47	74.00	144.00	77.49	65.24	141.00	1.02
CMS - 49	58.00	314.60	100.14	83.29	316.00	1.00
CMS - 51	63.00	157.29	86.78	72.78	160.00	0.98
CMS - 52	11.00	175.60	89.42	59.19	179.00	0.98
CMS - 53	158.00	165.00	112.48	61.38	170.00	0.97
CMS - 54	41.00	147.20	89.86	72.90	150.00	0.98
CMS - 55	48.00	228.00	105.06	70.86	230.00	0.99
CMS - 56	46.00	177.83	86.46	69.67	176.00	1.01
CMS - 57	51.00	507.33	136.13	88.97	507.00	1.00
CMS - 58	31.00	273.75	88.86	84.92	274.00	1.00
CMS - 59	62.00	277.60	94.27	79.87	278.00	1.00
CMS - 60	34.00	753.40	149.12	106.24	746.00	1.01
CMS - 61	219.00	149.14	77.34	65.12	149.00	1.00
CMS - 62	51.40	199.50	97.90	67.49	198.00	1.01
CMS - 63	41.00	141.00	83.19	60.62	140.00	1.01
CMS - 67	238.00	198.00	86.34	61.16	196.00	1.01
CMS - 68	248.50	270.60	105.16	78.12	271.00	1.00
GMS - 01	280.00	123.57	68.20	60.61	122.00	1.01
GMS - 02	364.00	179.86	78.78	68.15	178.00	1.01
GMS - 03	251.00	137.71	87.52	55.41	140.00	0.98
GMS - 04	196.00	316.67	87.53	82.52	314.00	1.01
GMS - 05	186.00	335.29	114.26	74.86	332.00	1.01
GMS - 06	13.00	228.43	83.73	74.36	231.00	0.99
YMS - 01	42.00	124.20	70.64	58.06	127.00	0.98
YMS - 04	37.00	144.00	65.56	63.24	145.00	0.99
YMS - 05	39.00	193.20	88.05	57.84	191.00	1.01
YMS - 06	19.00	156.33	73.68	59.73	160.00	0.98
YMS - 07	62.00	178.80	77.46	67.23	177.00	1.01
MMS - 01	275.00	213.00	75.66	78.24	213.00	1.00
MMS - 02	297.00	166.66	86.39	58.24	168.00	0.99
MMS - 03	256.00	106.62	52.32	54.62	109.00	0.98
Max	364.00	862.00	149.12	117.62	880.00	1.02
Min	11.00	87.17	52.32	51.39	88.00	0.96
Range	353	774.83	96.80	66.23	792.00	0.06
Mean	92.59	239.11	93.24	72.70	240.18	0.99
SD	87.22	142.14	19.48	13.44	142.93	0.02
S.Em±	11.16	18.20	2.49	1.72	18.31	0.01
CV	94.21	59.44	20.89	18.49	59.51	1.39

**Table 4:** Pulp, peel and stone parameters of mango seedling selections at villages of Bidar district

Selections	Pulp weight (g)	Peel weight (g)	Stone weight (g)	Peel thickness (mm)	% Pulp	% Peel	% Stone	Non edible part (g)	% Non-edible part	Fruit: pulp	Pulp: peel	Pulp: stone	Edible: non edible
CMS - 01	179.44	29.57	18.79	1.02	78.77	12.98	8.25	48.36	21.23	1.27	6.07	9.55	3.71
CMS - 05	647.72	127.3	86.98	2.98	75.14	14.77	10.09	214.28	24.86	1.33	5.09	7.45	3.02
CMS - 06	100.05	25.41	30.41	0.77	64.19	16.30	19.51	55.82	35.81	1.56	3.94	3.29	1.79
CMS - 09	196.01	39.21	25.18	1.64	75.27	15.06	9.67	64.39	24.73	1.33	5.00	7.78	3.04
CMS - 14	159.95	38.55	22.7	1.37	72.31	17.43	10.26	61.25	27.69	1.38	4.15	7.05	2.61
CMS - 15	252.67	84.57	56.09	2.98	64.24	21.50	14.26	140.66	35.76	1.56	2.99	4.50	1.80
CMS - 16	328.78	101.07	40.55	2.16	69.89	21.49	8.62	141.62	30.11	1.43	3.25	8.11	2.32
CMS - 17	103.41	46.77	21.02	1.85	60.40	27.32	12.28	67.79	39.60	1.66	2.21	4.92	1.53
CMS - 18	127.23	43.53	40.94	1.18	60.10	20.56	19.34	84.47	39.90	1.66	2.92	3.11	1.51
CMS - 19	125.22	26.43	42.95	1.02	64.35	13.58	22.07	69.38	35.65	1.55	4.74	2.92	1.80
CMS - 23	201.10	41.66	25.13	1.06	75.07	15.55	9.38	66.79	24.93	1.33	4.83	8.00	3.01
CMS - 24	124.44	37.83	32.23	1.29	63.98	19.45	16.57	70.06	36.02	1.56	3.29	3.86	1.78
CMS - 25	170.38	29.48	29.34	1.21	74.34	12.86	12.80	58.82	25.66	1.35	5.78	5.81	2.90
CMS - 26	206.94	41.88	34.38	1.26	73.07	14.79	12.14	76.26	26.93	1.37	4.94	6.02	2.71
CMS - 27	183.81	43.28	34.51	0.99	70.26	16.54	13.19	77.79	29.74	1.42	4.25	5.33	2.36
CMS - 29	101.19	36.70	32.51	1.20	59.38	21.54	19.08	69.21	40.62	1.68	2.76	3.11	1.46
CMS - 30	65.17	13.74	21.59	0.86	64.85	13.68	21.48	35.33	35.15	1.54	4.74	3.02	1.84
CMS - 31	273.44	69.39	25.57	1.38	74.22	18.84	6.94	94.96	25.78	1.35	3.94	10.69	2.88

CMS - 32	160.10	45.15	33.55	1.38	67.04	18.91	14.05	78.70	32.96	1.49	3.55	4.77	2.03
CMS - 33	208.08	47.53	37.39	1.44	71.02	16.22	12.76	84.92	28.98	1.41	4.38	5.57	2.45
CMS - 34	121.62	33.33	30.55	1.21	65.56	17.97	16.47	63.88	34.44	1.53	3.65	3.98	1.90
CMS - 35	145.75	33.86	24.56	1.38	71.39	16.58	12.03	58.42	28.61	1.40	4.30	5.93	2.49
CMS - 37	92.00	28.61	29.39	1.57	61.33	19.07	19.59	58.00	38.67	1.63	3.22	3.13	1.59
CMS - 40	112.90	35.22	20.28	1.51	67.04	20.91	12.04	55.50	32.96	1.49	3.21	5.57	2.03
CMS - 41	115.55	20.33	20.32	0.89	73.98	13.01	13.01	40.65	26.02	1.35	5.68	5.69	2.84
CMS - 42	334.98	114.92	50.1	2.64	67.00	22.98	10.02	165.02	33.00	1.49	2.91	6.69	2.03
CMS - 43	53.56	14.1	32.17	0.84	53.65	14.12	32.22	46.27	46.35	1.86	3.80	1.67	1.16
CMS - 44	98.39	18.83	30.78	0.86	66.48	12.72	20.80	49.61	33.52	1.50	5.23	3.20	1.98
CMS - 45	331.26	75.53	19.21	1.33	77.76	17.73	4.51	94.74	22.24	1.29	4.39	17.24	3.50
CMS - 46	59.77	11.31	16.09	1.24	68.57	12.98	18.46	27.40	31.43	1.46	5.28	3.71	2.18
CMS - 47	95.13	24.42	24.45	0.87	66.06	16.96	16.98	48.87	33.94	1.51	3.90	3.89	1.95
CMS - 49	231.05	47.21	36.34	1.11	73.44	15.01	11.55	83.55	26.56	1.36	4.89	6.36	2.77
CMS - 51	92.42	35.06	29.81	1.12	58.76	22.29	18.95	64.87	41.24	1.70	2.64	3.10	1.42
CMS - 52	110.84	38.91	25.85	1.05	63.12	22.16	14.72	64.76	36.88	1.58	2.85	4.29	1.71
CMS - 53	114.85	25.86	24.29	1.25	69.61	15.67	14.72	50.15	30.39	1.44	4.44	4.73	2.29
CMS - 54	93.20	38.07	15.93	1.03	63.32	25.86	10.82	54.00	36.68	1.58	2.45	5.85	1.73
CMS - 55	153.94	38.79	35.27	1.74	67.52	17.01	15.47	74.06	32.48	1.48	3.97	4.36	2.08
CMS - 56	113.96	41.07	22.8	0.97	64.08	23.10	12.82	63.87	35.92	1.56	2.77	5.00	1.78
CMS - 57	358.40	85.06	63.87	1.80	70.64	16.77	12.59	148.93	29.36	1.42	4.21	5.61	2.41
CMS - 58	188.17	46.3	39.28	1.15	68.74	16.91	14.35	85.58	31.26	1.45	4.06	4.79	2.20
CMS - 59	197.75	46.95	32.9	1.07	71.24	16.91	11.85	79.85	28.76	1.40	4.21	6.01	2.48
CMS - 60	594.65	95.01	63.74	1.95	78.93	12.61	8.46	158.75	21.07	1.27	6.26	9.33	3.75
CMS - 61	102.10	28.14	18.9	1.24	68.46	18.87	12.67	47.04	31.54	1.46	3.63	5.40	2.17
CMS - 62	131.50	38.33	29.67	1.25	65.91	19.21	14.87	68.00	34.09	1.52	3.43	4.43	1.93
CMS - 63	98.20	19.68	23.12	0.74	69.65	13.96	16.40	42.80	30.35	1.44	4.99	4.25	2.29
CMS - 67	141.50	29.37	27.13	1.35	71.46	14.83	13.70	56.50	28.54	1.40	4.82	5.22	2.50
CMS - 68	202.95	44.19	23.46	0.96	75.00	16.33	8.67	67.65	25.00	1.33	4.59	8.65	3.00
GMS - 01	94.28	13.84	15.45	0.77	76.30	11.20	12.50	29.29	23.70	1.31	6.81	6.10	3.22
GMS - 02	132.88	20.16	26.82	0.64	73.88	11.21	14.91	46.98	26.12	1.35	6.59	4.95	2.83
GMS - 03	106.66	12.13	18.92	0.87	77.45	8.81	13.74	31.05	22.55	1.29	8.79	5.64	3.44
GMS - 04	258.94	23.78	33.95	0.84	81.77	7.51	10.72	57.73	18.23	1.22	10.89	7.63	4.49
GMS - 05	261.83	34.27	39.19	1.17	78.09	10.22	11.69	73.46	21.91	1.28	7.64	6.68	3.56
GMS - 06	178.27	19.78	30.38	0.88	78.04	8.66	13.30	50.16	21.96	1.28	9.01	5.87	3.55
YMS - 01	82.23	24.32	17.65	1.42	66.21	19.58	14.21	41.97	33.79	1.51	3.38	4.66	1.96
YMS - 04	97.57	24.87	21.56	0.92	67.76	17.27	14.97	46.43	32.24	1.48	3.92	4.53	2.10
YMS - 05	125.57	29.38	38.25	1.22	64.99	15.21	19.80	67.63	35.01	1.54	4.27	3.28	1.86
YMS - 06	92.74	32.12	31.47	1.52	59.32	20.55	20.13	63.59	40.68	1.69	2.89	2.95	1.46
YMS - 07	109.45	30.37	38.98	1.54	61.21	16.99	21.80	69.35	38.79	1.63	3.60	2.81	1.58
MMS - 01	163.61	25.49	23.9	0.97	76.81	11.97	11.22	49.39	23.19	1.30	6.42	6.85	3.31
MMS - 02	96.66	36.9	33.1	1.26	58.00	22.14	19.86	70.00	42.00	1.72	2.62	2.92	1.38
MMS - 03	62.37	28.16	16.09	1.25	58.50	26.41	15.09	44.25	41.50	1.71	2.21	3.88	1.41
Max	647.72	127.30	86.98	2.98	81.77	27.32	32.22	214.28	46.35	1.86	10.89	17.24	4.49
Min	53.56	11.31	15.45	0.64	53.65	7.51	4.51	27.40	18.23	1.22	2.21	1.67	1.16
Range	594.16	115.99	71.53	2.34	28.12	19.81	27.71	186.88	28.12	0.64	4.45	15.57	3.33
Mean	168.28	39.89	30.94	1.29	68.76	16.87	14.35	70.84	31.24	1.46	4.45	5.44	2.35
SD	110.78	24.20	12.77	0.47	6.34	4.29	4.61	34.67	6.34	0.14	1.67	2.42	0.72
S.Em±	14.19	3.10	1.63	0.06	0.82	0.55	0.58	4.43	0.82	0.02	0.22	0.31	0.09
CV	65.84	60.68	41.26	37.20	9.23	25.40	32.06	48.93	20.33	9.46	37.69	44.50	30.80



**Plate 1a:** Morphological variation in fruits of seedling selections of mango

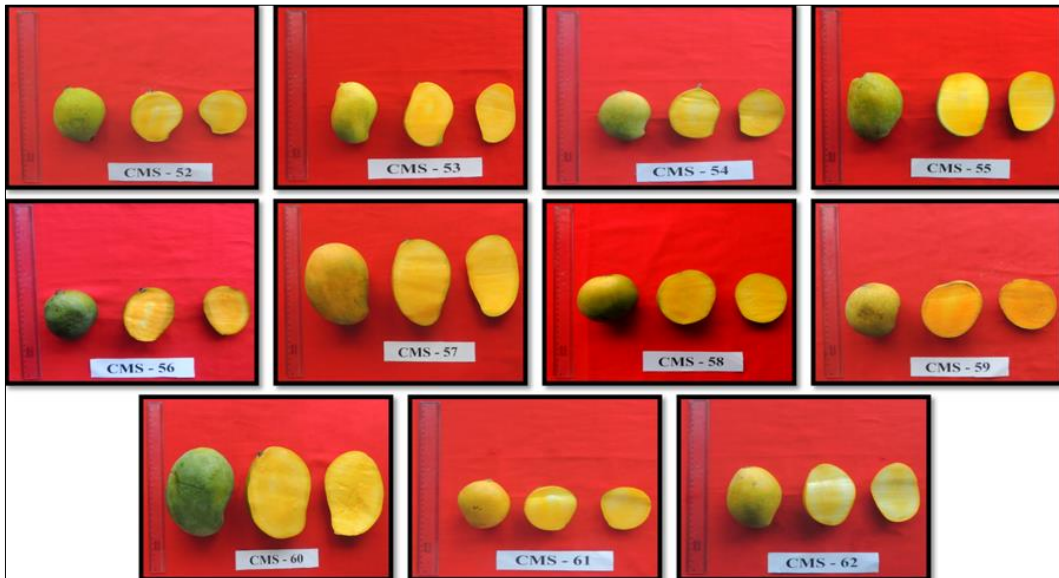


**Plate 1b:** Morphological variation in fruits of seedling selections of mango

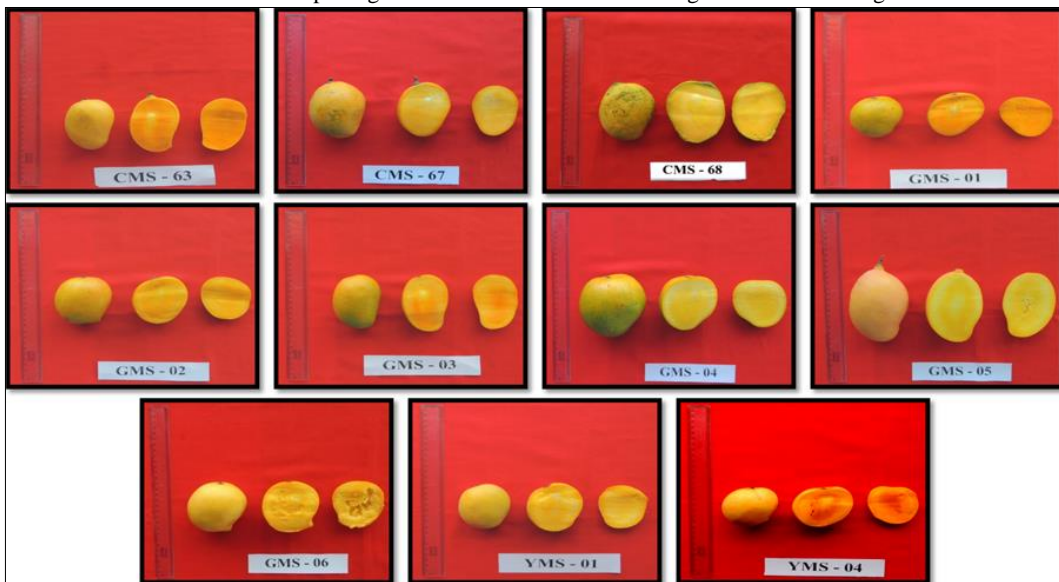


**Plate 1c:** Morphological variation in fruits of seedling selections of mango





**Plate 1d:** Morphological variation in fruits of seedling selections of mango



**Plate 1e:** Morphological variation in fruits of seedling selections of mango



**Plate 1f:** Morphological variation in fruits of seedling selections of mango

**Conclusions**

'CMS-05' and 'GMS-04' were best selections among sixty-one selections. Selection 'CMS-05' recorded maximum (862.00 g) fruit weight with bold fruit and higher pulp content (647.72 g) and pulp qualities like higher pulp percentage (81.77%) with lowest peel percentage (7.51%) were recorded 'GMS-04'. CMS-67 and GMS-02 are the best in yield with a

yield of 238 kg and 364.00 kg per tree.

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